

In the Claims:

Please amend the claims as follows:

1. (currently amended) A method for determining a position ($P_{xyz}(MT)$) of a signal transmitter, the method (MT) comprising ~~the steps of:~~

receiving a direct sequence spread spectrum signal (S_{MT}) from the transmitter (MT) in each of at least three physically separated sensors (~~100a, 100b, 100c, 100d~~) whose respective positions are known, the signal (S_{MT}) representing a set of symbols,

correlating, in each of the sensors (~~100a, 100b, 100c, 100d~~) a representation ($S_{BB}, \langle S_{BB} \rangle$) of the received signal (S_{MT}) with at least one local spreading sequence (S_{PP}, S_{bin}) to determine a respective estimated transmission delay (d) of the received signal (S_{MT}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_c), the correlating ~~step~~ producing a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_c/2$), and

calculating a distance (D_{MT-100}) between the signal transmitter (MT) and each of the at least three sensors (~~100a, 100b, 100c, 100d~~) based on the respective estimated transmission delays (d),

wherein the correlating ~~step comprising the further sub-steps of:~~ comprises:

over-sampling the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to obtain a corresponding over-sampled representation of the received signal ($\langle S_{BB} \rangle$), the over-sampling being equivalent to a reduced chip period (T_{cl}) which is shorter than the nominal chip period (T_c),

selecting a local spreading sequence (S_{PP}) containing poly-phased symbol values which are different from the set of symbols represented by the received signal (S_{MT}), the selected local spreading sequence (S_{PP}) having a nominal chip period being equivalent to the reduced chip period (T_{Ct}), and

cross-correlating the over-sampled representation ($\langle S_{BB} \rangle$) of the received signal (S_{MT}) with the selected local spreading sequence (S_{PP}) to obtain an improved uncertainty region which is more limited than one half nominal chip period ($T_c/2$).

2. (currently amended) The method ~~A method~~ according to claim 1, wherein prior to said cross-correlating ~~sub-step~~, the correlating ~~step involving~~ further comprises an auto-correlating ~~sub-step~~ wherein the representation (S_{BB}) of the received signal (S_{MT}) is correlated with a local copy (S_{bin}) of the transmitted spreading sequence to provide an uncertainty region of one half nominal chip period ($T_c/2$) around an auto-correlation peak (~~501~~).

3. (currently amended) The method ~~A method~~ according to claim 1, further comprising ~~the steps of:~~

examining a phase difference function ($\Delta\phi$) which describes a phase difference between neighboring samples in a cross-correlation function resulting from said cross-correlating ~~sub-step~~,

detecting a position (P) in said phase difference function ($\Delta\phi$) where the phase difference between neighboring samples exceeds a predetermined magnitude ($\Delta\phi_{Th}$), and

defining the improved uncertainty region adjacent to samples in the over-sampled representation of the received signal ($\langle S_{BB} \rangle$) equivalent to said position (P).

4. (currently amended) The method ~~A-method~~ according to claim 1, wherein the improved uncertainty region ~~having~~ has an extension which is equal to one half reduced chip period ($T_{Ch}/2$).

5. (currently amended) The method ~~A-method~~ according to claim 1, wherein the over-sampling, the selecting a local spreading sequence, and the cross-correlating are repeated ~~repeating said further sub-steps~~ with progressively reduced chip periods and uncertainty regions until a desired limitation of the uncertainty region is achieved.

6. (currently amended) The method ~~A-method~~ according to claim 5, wherein the reduced chip period (T_{Ch}) with respect to a first over-sampling ~~representing~~ represents an over-sampling by an integer factor of the transmitted direct sequence spread spectrum signal (S_{MT}), said integer factor being larger than one.

7. (currently amended) The method ~~A-method~~ according to claim 6, wherein the reduced chip period (T_{Ch}) with respect to any subsequent over-sampling after the first over-sampling ~~representing~~ represents an integer factor times a foregoing over-sampling, said integer factor being larger than one.

8. (currently amended) The method ~~A-method~~ according to claim 1, wherein the over-sampling ~~involving~~ comprises a linear interpolation between neighboring sampling points.

9. (currently amended) The method ~~A method~~ according to claim 1, wherein the over-sampling ~~involving~~ comprises one or more repetitions of each sampling value.

10. (currently amended) A computer program directly loadable into the internal memory of a computer, comprising:

program code for determining a position ($P_{xyz}(MT)$) of a signal transmitter (MT), the program code comprises sets of instructions for:

receiving a direct sequence spread spectrum signal (S_{MT}) from the transmitter (MT) in each of at least three physically separated sensors (~~100a, 100b, 100c, 100d~~) whose respective positions are known, the signal (S_{MT}) representing a set of symbols,

correlating, in each of the sensors (~~100a, 100b, 100c, 100d~~) a representation ($S_{BB}, \langle S_{BB} \rangle$) of the received signal (S_{MT}) with at least one local spreading sequence (S_{PP}, S_{bin}) to determine a respective estimated transmission delay (d) of the received signal (S_{MT}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_C), the correlating step producing a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_C/2$), and

calculating a distance (D_{MT-100}) between the signal transmitter (MT) and each of the at least three sensors (~~100a, 100b, 100c, 100d~~) based on the respective estimated transmission delays (d), wherein the correlating ~~step comprising the further comprises: sub-steps of:~~

over-sampling the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to obtain a corresponding over-sampled representation of the received signal ($\langle S_{BB} \rangle$), the over-sampling being equivalent to a reduced chip period (T_{Ct}) which is shorter than the nominal chip period (T_C),

selecting a local spreading sequence (S_{PP}) containing poly-phased symbol values which are different from the set of symbols represented by the received signal (S_{MT}), the selected local spreading sequence (S_{PP}) having a nominal chip period being equivalent to the reduced chip period ($T_{C/2}$), and

cross-correlating the over-sampled representation ($\langle S_{BB} \rangle$) of the received signal (S_{MT}) with the selected local spreading sequence (S_{PP}) to obtain an improved uncertainty region which is more limited than one half nominal chip period ($T_C/2$).

11. (currently amended) A computer readable carrier medium, having a program code recorded thereon, wherein the program code includes sets of instructions comprising:

first computer instructions for receiving a direct sequence spread spectrum signal (S_{MT}) from the transmitter (MT) in each of at least three physically separated sensors (~~100a, 100b, 100c, 100d~~) whose respective positions are known, the signal (S_{MT}) representing a set of symbols,

second computer instructions for correlating, in each of the sensors (~~100a, 100b, 100c, 100d~~) a representation ($S_{BB}, \langle S_{BB} \rangle$) of the received signal (S_{MT}) with at least one local spreading sequence (S_{PP}, S_{bin}) to determine a respective estimated transmission delay (d) of the received signal (S_{MT}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_C), the correlating step producing a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_C/2$), and

third computer instructions for calculating a distance (D_{MT-100}) between the signal transmitter (MT) and each of the at least three sensors (~~100a, 100b, 100c, 100d~~) based on the respective estimated transmission delays (d), wherein the correlating ~~step comprising the further~~

~~sub-steps of:~~ comprises:

forth computer instructions for over-sampling the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to obtain a corresponding over-sampled representation of the received signal ($\langle S_{BB} \rangle$), the over-sampling being equivalent to a reduced chip period (T_{c1}) which is shorter than the nominal chip period (T_c),

fifth computer instructions for selecting a local spreading sequence (S_{PP}) containing poly-phased symbol values which are different from the set of symbols represented by the received signal (S_{MT}), the selected local spreading sequence (S_{PP}) having a nominal chip period being equivalent to the reduced chip period (T_{c1}), and

sixth computer instructions for cross-correlating the over-sampled representation ($\langle S_{BB} \rangle$) of the received signal (S_{MT}) with the selected local spreading sequence (S_{PP}) to obtain an improved uncertainty region which is more limited than one half nominal chip period ($T_c/2$).

12. (currently amended) A sensor (~~100~~) for determining a distance (D_{MT-100}) to a signal transmitter (~~MT~~) based on a direct sequence spread spectrum signal (S_{MT}) received from the transmitter (~~MT~~), the signal (S_{MT}) representing a set of symbols, the sensor (~~100~~) comprising:

a timing unit (~~220~~) adapted to determine an estimated transmission delay (~~d~~) of the received signal (S_{MT}) based on a correlation between at least one representation ($S_{BB}, \langle S_{BB} \rangle$) of the received signal (S_{MT}) and at least one local spreading sequence (S_{PP}, S_{bth}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_c), the timing unit (~~220~~) being adapted to produce a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_c/2$), and

a calculating circuit (~~230~~) adapted to calculate the distance (D_{MT-100}) ~~on the basis of~~ based

on the transmission delay (~~d~~) produced by said timing unit (~~220~~), wherein the timing unit (~~220~~) comprises:

a sampling circuit (~~221~~) adapted to over-sample the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to produce a corresponding over-sampled representation ($\langle S_{BB} \rangle$) of the received signal (S_{MT}), the over-sampling being equivalent to a reduced chip period (T_{Cl}) which is shorter than the nominal chip period (T_c),

at least one bank of spreading sequences (~~223a~~) adapted to provide a local spreading sequence (S_{pp}) containing poly-phased symbol values which are different from the set of symbols represented by the signal (S_{MT}), said local spreading sequence (S_{pp}) having a nominal chip period which is equivalent to the reduced chip period (T_{Cl}), and

a correlating circuit (~~222~~) adapted to cross-correlate the over-sampled representation ($\langle S_{BB} \rangle$) of the received signal (S_{MT}) with said local spreading sequence (S_{pp}) to obtain an improved uncertainty region being more limited than one half nominal chip period ($T_c/2$).

13. (currently amended) The sensor ~~A sensor (100)~~ according to claim 12, wherein the timing unit (~~220~~) is adapted to, before cross-correlating the over-sampled representation ($\langle S_{BB} \rangle$) of the received signal (S_{MT}) with said local spreading sequence (S_{pp}), auto-correlate the representation (S_{BB}) of the received signal (S_{MT}) with a local copy (S_{bin}) of the transmitted spreading sequence from the at least one bank of spreading sequences (~~223b~~) such that a chip level synchronization is obtained within an uncertainty region of one half nominal chip period ($T_c/2$) around an auto-correlation peak.

14. (currently amended) The sensor ~~A sensor (100)~~ according to claim 12, ~~wherein it~~

~~comprises~~ further comprising:

a control circuit (240) adapted to control the timing unit (220) such that for a particular representation (S_{BB} , ~~$\langle S_{BB} \rangle$~~) of the received signal (S_{MT}) the at least one bank of spreading sequences (223a, 223b) provides an appropriate local spreading sequence (S_{PP} ; S_{bin}) to the correlating circuit (222).

15. (currently amended) A system for determining a position ($P_{xyz}(MT)$) of a signal transmitter (MT) transmitting a direct sequence spread spectrum signal (S_{MT}), the system comprising:

at least three physically separated sensors (100a, 100b, 100c, 100d), each sensor being adapted to receive the signal (S_{MT}) transmitted from the signal transmitter (MT), the respective position of each sensor being known, and

a central node (110) adapted to receive distance data (D_{MT-100}) from each of the sensors (100a, 100b, 100c, 100d), the distance data (D_{MT-100}) representing a respective distance between the transmitter (MT) and the sensor (100a, 100b, 100c, 100d), wherein each of the sensors (100a, 100b, 100c, 100d) ~~is the sensor (100) according to claim 12~~ comprises:

a timing unit adapted to determine an estimated transmission delay of the received signal based on a correlation between at least one representation of the received signal and at least one local spreading sequence, the received direct sequence spread spectrum signal having a nominal chip period, the timing unit being adapted to produce a chip level synchronization at least within an uncertainty region of one half nominal chip period, and

a calculating circuit adapted to calculate the distance based on the transmission delay produced by said timing unit, wherein the timing unit comprises:

a sampling circuit adapted to over-sample the representation of the received signal within the uncertainty region to produce a corresponding over-sampled representation of the received signal, the over-sampling being equivalent to a reduced chip period which is shorter than the nominal chip period,

at least one bank of spreading sequences adapted to provide a local spreading sequence containing poly-phased symbol values which are different from the set of symbols represented by the signal, said local spreading sequence having a nominal chip period which is equivalent to the reduced chip period, and

a correlating circuit adapted to cross-correlate the over-sampled representation of the received signal with said local spreading sequence to obtain an improved uncertainty region being more limited than one half nominal chip period.